1385801 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

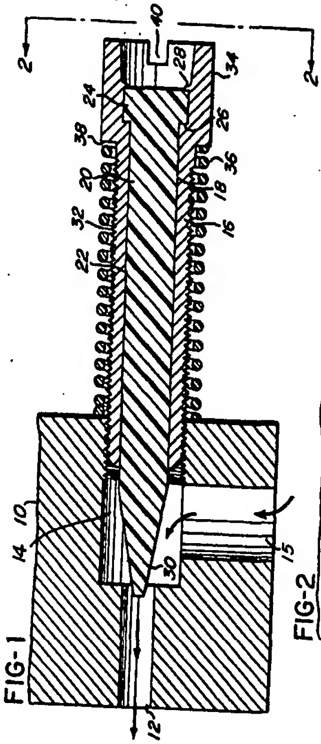

FIG-1

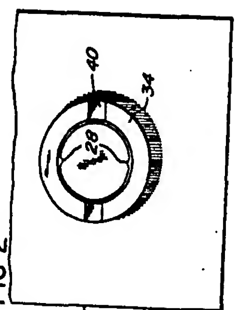

FIG-2

PATENT SPECIFICATION

(11) 1385801

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(54) THERMALLY RESPONSIVE VALVE ASSEMBLY

(71) We, VERNAY LABORATORIES, INC., of 116 College Street, Yellow Springs, Ohio 45387, United States of America, a corporation organised under the laws of the State of Ohio, United States of America,

do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

It is often desirable to regulate the flow of a fluid through a port in response to changes in temperature. For example, United States patent specification 3,340,893, discloses a throttle to provide a constant resistance to flow in a hydraulic system despite changes in the temperature of the hydraulic fluid flowing through the hydraulic system. Similarly, United States patent specifications 3,540,650 and 3,559,885, discloses mixing devices in which the proportions of hot and cold fluids are varied to maintain the mixed fluid at some preselected temperature.

In controlling the flow of air, fuel or an air-fuel mixture into a carburetor during idling it is also desirable that the amount of open area through the inlet port be varied in response to temperature changes. While each of the above noted patents is designed to accomplish regulation of fluid flow in response to temperature changes, it will be noted that each of these flow regulating devices is formed of several interconnected parts which, of course, necessarily increases the cost of each of such regulating devices as well as increasing the number of potential sources of malfunction. In the manufacture of relatively high volume products, such as carburetors, it is desirable to have a regulating member which is as inexpensive as possible, yet durable and accurate.

The present invention consists in a thermally responsive valve assembly comprising a wall having a port which includes an outer portion and a substantially coaxial inner portion, a substantially cylindrical valve shell member secured to the outer portion of the port, a rod-like valve core member slidable in the valve shell member, one end of the valve core member being fixed to an adjacent portion of the valve shell member and the opposite end of the valve core member projecting from the valve shell member into the inner portion of the port, the coefficient of linear thermal expansion of one of said valve members being substantially greater than the coefficient of linear thermal expansion of the other of said valve members so as to cause said opposite end of the valve core member to move into and out of the inner portion of the port and thereby regulate flow through the inner portion of the port.

The valve assembly according to the invention is responsive to changes in temperature, the valve core member being used to regulate the effective cross-sectional area of the port to control fluid flow therethrough. The valve device, itself, consists of only two parts, namely the valve shell and core members, and hence may be very inexpensive to manufacture, realtively rugged and maintenance-free. When in use, the valve device may be screwed into the outer portion of the port so that the projecting end of the valve core is positioned within the inner portion of the port for regulating fluid flow therethrough. Since the materials of which the shell and core are formed have coefficients of linear thermal expansion which differ greatly from each other, changes in temperature will cause either the valve core or the shell to expand, advancing or retracting the projecting end of the core into or out of the inner portion of the port and varying the effective open area of the port. Since the lengths of the core and shell may be much greater than their diameters, expansion and contraction will be principally in the longitudinal direction. The present invention may, therefore, provide a compact, relatively simple, and inexpensive valve assembly which nonetheless, provides accurate control over fluid flow through a port in response to temperature changes.

In order that the invention may be more readily understood, reference will now be

made to the accompanying drawing, in which:—

Fig. 1 is a cross-sectional view through one embodiment of the invention, and

Fig. 2 is a view taken on line 2—2 of Fig. 1.

A portion 10 of a wall, for example, of a carburetor, is provided with a port comprising an enlarged outer portion 14 and a substantially coaxial inner portion 12. An inlet 15 intersects the port. The enlarged portion 14 is threaded at its outer end and to this portion is secured a substantially cylindrical valve casing or shell member 16 having an internal bore 18 extending axially thereof. An elongated, unitary, rod-like valve core member 20 is received in the bore of the valve shell, and is provided with a shank portion 22 of sufficiently smaller diameter than the internal diameter of the bore 18 to permit free movement of the shank portion 22 within the bore 18. One end 24 of the valve core 22 is enlarged to provide a a shoulder 26 which abuts against an opposing shoulder of the casing 16 and is fixed in this position in any convenient manner, such as by deforming a portion of the casing into contact with the outer surface of the enlarged portion 24, as at 28. The opposite end 30 of the valve core 20 is conically shaped and protrudes outwardly of the valve shell and into the inner portion 12 of the flow port.

The outer surface of at least a portion of the shell 16 is provided with external threads 32 which are complementary to the internal threads of the outer portion 14 to permit the casing or shell of the valve member to be threaded into the wall 10. The casing or shell 16 is also provided with an enlarged portion 34 and a coil spring 36 surrounds the shank of the casing 16 and bears at one end against the wall 10 and at its opposite end against the shoulder 38 formed by the enlarged portion 34. It will also be noted from Figs. 1 and 2 that the enlarged portion of the casing 16 is provided with a tool engageable portion such as a slot 40.

The valve device, which consists of the valve casing or shell member 16 and the valve core member 20, will usually be assembled at one point and shipped as a unit to another point for attachment to the wall 10. To attach the valve device the casing 16 is screwed into the wall 10 until the desired clearance is achieved and the conically shaped outwardly protruding portion 30 of the valve core 20 is positioned within the port by the amount necessary to give the desired flow area through the inner portion 12 of the port at the then prevailing ambient temperature. The spring 36, bearing against the shoulder 38 and the wall 10, serves to maintain the casing 16 and the core 20 in this preset position.

Fluid will flow, for example, in the direction indicated by the arrows through the inlet 15 and port when the unit with which the valve device is associated is in operation, although it will be appreciated that the flow direction could be reversed. The valve core member 20 is formed of a material having a coefficient of linear thermal expansion appreciably different from the coefficient of linear thermal expansion of the valve casing member 16. Thus, as the temperature increases the core 20 and the casing 16 will expand appreciably different amounts and, since the core 20 is fixed at one end to the casing 16, its conically shaped opposite end will move with respect to the port 12. For example, if the coefficient of linear thermal expansion of the core is relatively high as compared to the shell, the core will expand and move towards the left as seen in Fig. 1 of the drawings, thereby decreasing the effective open area of the inner portion 12 of the port. On the other hand, if the coefficient of linear thermal expansion of the shell 16 is relatively high with respect to the core, the shell will expand and move the conically shaped end 30 towards the right as seen in Fig. 1.

As noted above, the shank 22 of the core 20 is made of sufficiently smaller cross sectional area than the internal bore 18 of the casing 16 to permit relatively free movement between the unattached shank portion and the surrounding bore 18. Of course, upon a decrease in temperature the core 20 and the casing 16 will contract appreciably different amounts, moving the conically shaped opposite end of the core oppositely to the directions described above.

As noted above, the coefficient of linear thermal expansion of the valve core member 20 is made sufficiently different from that of the valve casing or shell member 16 to provide the necessary response to temperature changes. To accomplish this the coefficient of linear thermal expansion of one of the members 20 and 16 should be at least three times greater than the other. Utilizing combinations of readily available materials this difference will be in the range of approximately three to twenty-five.

A variety of materials may be used to give the desired degree of expansion upon changes in temperature and relatively rigid, organic polymers, both thermosetting and thermoplastic, such as polyvinylidene fluoride, polyethylene, acrylics, acetal resins and nylon have the desired characteristics necessary for the practice of the present invention. Thus, either the valve casing or the core may be formed of one of the above materials and the other member formed of a material such as steel having a coefficient of linear thermal expansion of approximately 6×10^{-6} inch/inch/°F., although a glass fibre filled nylon having 20—40% glass fibre will also function satisfactorily. Thus, forming one of the members, either the shell or the core, of steel and the remaining member of polyvinylidene fluoride, the coefficient of linear thermal expansion of the member formed of polyvinylidene fluoride will be approximately thirteen times that of the member formed of steel.

Regardles of the specific materials utilized, although of course, the materials selected must be compatible with the temperatures and fluids expected to be encountered, it will be seen that the present invention provides a thermally responsive valve assembly in which either the valve core member, itself, or the valve casing or shell member also serves as the actuating mechanism, and in which the construction is extremely simple thereby providing an inexpensive, compact and maintenance-free construction.

WHAT WE CLAIM IS:—

1. A thermally responsive valve assembly comprising a wall having a port which includes an outer portion and a substantially coaxial inner portion, a substantially cylindrical valve shell member secured to the outer portion of the port, a rod-like valve core member slidable in the valve shell member, one end of the valve core member being fixed to an adjacent portion of the valve shell member and the opposite end of the valve core member projecting from the valve shell member into the inner portion of the port, the coefficient of linear thermal expansion of one of said valve members being substantially greater than the coefficient of linear thermal expansion of the other of said valve member so as to cause said opposite end of the valve core member to move into and out of the inner portion of the port and thereby regulate flow through the inner portion of the port.

2. An assembly as claimed in claim 1, wherein said opposite end of the valve core member is of substantially conical configuration.

3. An assembly as claimed in claim 1 or 2, wherein the valve shell member has external threads and a tool engageable portion and is engaged with internal threads in the outer portion of the port.

4. An assembly as claimed in claim 1, 2 or 3, wherein a coil spring encircles the valve shell member and bears against the wall at one end and an enlarged outer end of the valve shell member at its opposite end.

5. An assembly as claimed in claim 1, 2, 3 or 4, including an inlet intersecting the port.

6. An assembly as claimed in any one of the preceding claims, wherein one of said valve members is formed of a relatively rigid, organic polymeric material.

7. An assembly as claimed in claim 6, wherein said material comprises polyvinylidene fluoride.

8. An assembly as claimed in claim 6, wherein said material comprises polyethylene.

9. An assembly as claimed in claim 6, wherein said material comprises nylon.

10. An assembly as claimed in claim 6, wherein said material comprises an acrylic compound.

11. An assembly as claimed in claim 6, wherein said material comprises an acetal resin.

12. An assembly as claimed in any one of the preceding claims 6 to 11, wherein the other valve member is formed from steel.

13. An assembly as claimed in anyone of the preceding claims 1 to 11, wherein the coefficient of linear thermal expansion of one of said valve members is at least three times greater than the coefficient of linear thermal expansion of the other of said members.

14. An assembly as claimed in anyone of the preceding claims 1 to 11, wherein the coefficient of linear thermal expansion of one of said valve members is approximately thirteen times greater than the coefficient of linear thermal expansion of the other of said members.

15. A thermally responsive valve assembly constructed substantially as hereinbefore described with reference to the accompanying drawings.

16. A carburetor incorporating a thermally responsive valve assembly as claimed in any one of the preceding claims.

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Reference has been directed in pursuance of section 9, subsection (1) of the Patents Act 1949, to Patent No. 1,293,709.

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